The Coal Situation

Vol. 7 – No. 4
SEPTEMBER, 1987

THE CHINA POTENTIAL

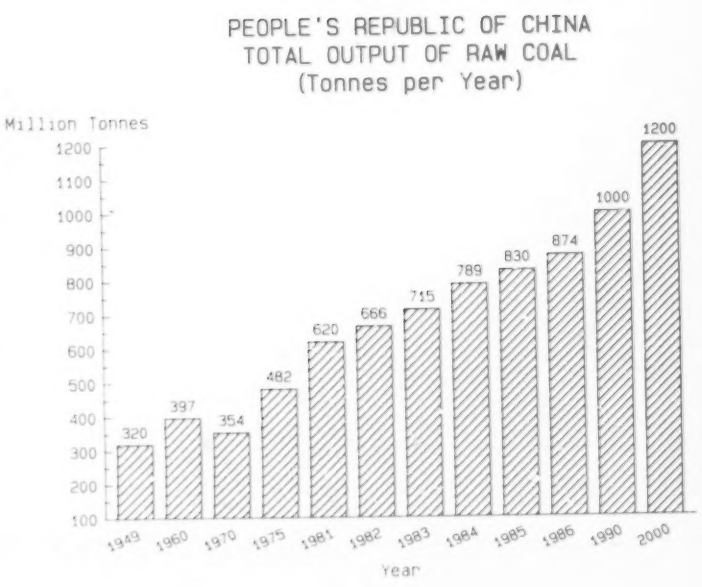
Much has been written over the past several years with regard to the Chinese coal industry. The *de rigueur* conversation between coal executives has one supporting the threat of increased Chinese coal exports due to the enormous production and reserve base, while the other attempts to placate these fears by citing China's quality, infrastructure and financial problems. As with most complex issues, there are no black and white answers to the conundrum of future coal export levels for China; only opinions based on the interpretation of available information. For this author, a recent one month tour of the coal provinces of Hebei, Shanxi, Shaanxi and Yunnan, and numerous meetings with the Ministry of Coal Industry, have led to the opinion that China *will* increase her coal exports. This is not a statement based on in-depth technical evaluations of rail and port infrastructure, schedules for mine expansions or supply/demand forecasts. Rather, it is based on an impression of the country's level of resolve as shown through the development of mines and improvements in delivery systems actually accomplished to date. Furthermore, there is no apparent let-up in sight.

Production Capability

In 1986 China surpassed the United States to become the world's largest producer of coal. The figure of 874 million tonnes is impressive enough on its own. Even more notable, however, is the growth as depicted by the graph in Figure 1. This graph also shows China's production goal of 1.2 billion tonnes by the year 2000.

Even though the historic growth rate makes the goal for 2000 look relatively attainable, it is important to note that my opinion of increased coal exports is not predicated on achievement of the forecasted levels. Although it is true that China is faced with the chronic dilemma of a shortage of coal for domestic consumption, I see this situation as one which facilitates an increase in exports rather than being a proverbial "ball and chain". The reasons for this are described later in this paper.

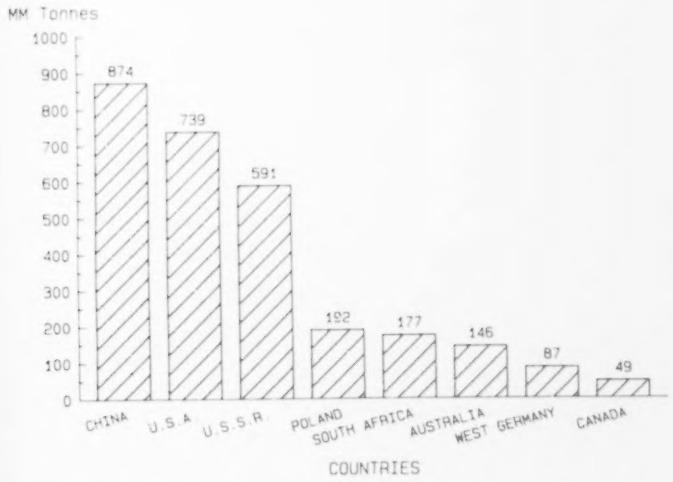
Figure 1



Figures 2 and 3 and 4 graphically depict the production, export, and exports as percentage of production for the major coal supplying nations. It is evident (Figure 4) that the P.R.C., with an export to production percentage of only 1%, has room for increases with only small shifts from domestic use to export. Furthermore, many importing nations are receptive to Chinese coal if for no other reason than to diversify their coal supplies away from the traditional nations. Afterall, for an industry (coal) that relies partly on nations' desires not to be overly reliant on OPEC for energy requirements, there are relatively few players. It is also painfully obvious that two of the three largest exporters (South Africa and Australia) are currently facing extremely tense labor disputes. Indeed, the ever cautious consumers will be encouraging China to free up more of her coal for export. From China's viewpoint, a trebling of the 1986 export level to 30 million tonnes without any associated increase in production would result in a percentage of exports to production of only 3.4%; still lower than any other nation. But, production *will* be growing and therefore the allocation of export is of an even lower significance relative to domestic requirements.

Figure 2

1986 HARD COAL PRODUCTION *



* excludes brown coals and lignite

It is, therefore, clear to this author that China can make coal available for export. After all, if you produce and consume 900+ million tonnes of coal, and are not fully satisfying all requirements, the elimination of 30 or 40 million tonnes to the external market is rather insignificant. The gains from trade could easily offset forgone activities internally. The question then becomes, can she move it to port and load it?

Export Capability

There are some definite constraints to China's ability to move coal from the mining districts (North) to the population centers (South and East). What is less obvious is how this situation facilitates China's ability to increase export capability.

Figure 3

1986 COAL EXPORTS

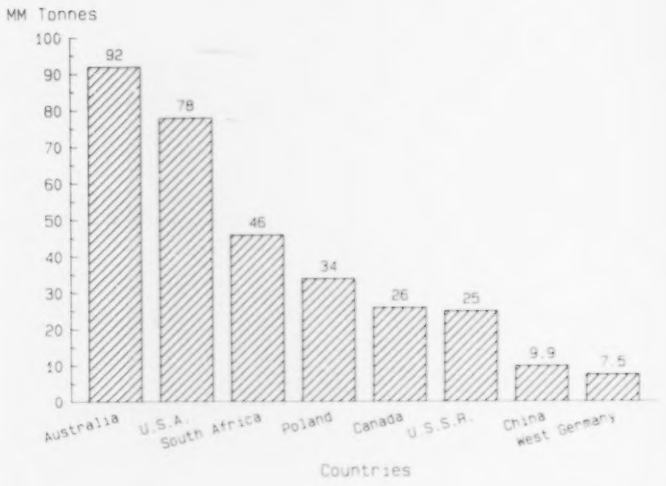
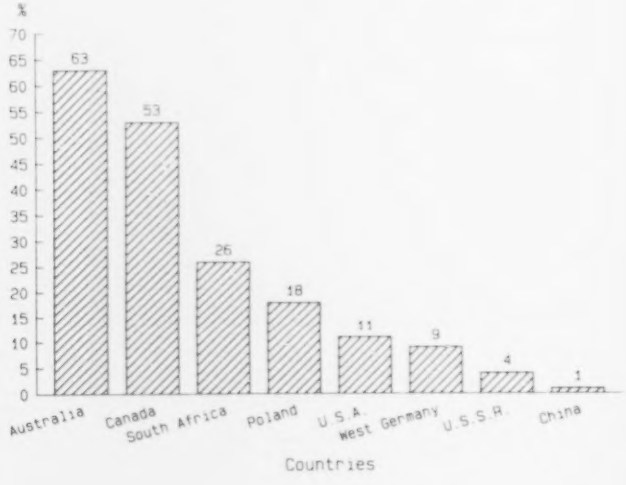


Figure 4

1986 % EXPORTS TO PRODUCTION



Coal currently accounts for slightly over 70% of China's domestic primary energy consumption (see Table 1) and this is forecasted to hold and even increase slightly through the year 2000. This will most likely result in a continued situation of short supply for domestic consumption; primarily for power generation and household use. The stated goal is to increase domestic power so that 90% of the population is reached by 2000. This in turn requires that China expand its infrastructure for moving coal. Herein lies the advantage.

TABLE 1

FUEL CONSUMPTION

Coal	*73%*
Petroleum	*21%*
Hydro-Electric	*4%*
Natural Gas	*2%*

Whereas most coal projects, particularly those requiring rail and port infrastructure, are faced with the need to obtain long term sales contracts in the export market *prior* to commencing development, China is in the rare situation of having to expand rail and port facilities regardless of the latter decision of how much to export. In other words, the expansion of rail and port facilities is not dependent on the current weak export market, but on China's strong internal demand. The best mode of transportation is the north-south coastal route. Therefore, China is already expanding the capacity of railroads from the northern coal fields to the main coal loading ports. This is particularly true for the Datong area of the province of Shanxi. Shanxi currently accounts for over 24% of China's total coal output and projections call for this to increase to over 30% by the year 2000.

The rail projects witnessed by this author were impressive to say the least. The existing rail line from Datong to the port of Quinhuangdao apparently has now been double tracked and electrified. Furthermore, an entirely separate unit train rail line is under construction. This is the line on which the new An Tai Bao export coal will have first priority. It is reported that completion of this line in late 1988 will take rail capacity to Quinhuangdao to 110 million tonnes per year.

The ports are also undergoing expansion. Quinhuangdao, for example, can currently handle up to 50,000 DWT vessels and has a throughput capacity of 25 million tonnes per year. After completion of the Phase III expansion (currently scheduled for the end of 1989), Quinhuangdao will accept vessels up to 100,000 DWT size and will have loading capacity of 70 million tonnes per year. Obviously, expansions of such scope are not geared solely to the export market. Rather, most of this new capacity will be used for shipping coal south along the coast to Shanghai and up the Yangtze River. This internal demand is also the basis for expansion plans of the other Northern ports such as Lianyungang, Dalian and Qindao. Therefore, my conclusion is that infrastructure will not be a constraint to China's ability to double or triple coal exports.

Dedicated Export Projects

One also does *not* get the impression that China will be constructing "export dedicated" projects. There seems to be a new plan which does not rely on foreign joint venture partners. This is most likely due to a reluctance to take on foreign debt, a desire not to be committed to minimum export levels and a realization that increased exports are better coming from the internally generated need to expand. It is doubtful that there will be another project of the scope or structure of the An Tai Bao Surface Mine Joint Venture.

Clearly, the Chinese have already decided to develop the enormous, low strip ratio Shen Mu coal reserves of the Shaanxi province without foreign partners. Perhaps the real importance of Shen Mu will not be as export coal, but in meeting domestic needs so that more Datong coal can be made available for export. Datong coal is of poorer quality but enjoys relative proximity to ports.

In 1986 Shaanxi province produced 28.6 million tonnes of coal, of which 6.5 million tonnes were transported out of state. Plans for Shen Mu alone call for capacity of 30 to 50 million tonnes per year. This northern area of Shaanxi enjoys abundant water resources which will aid in transportation and the siting of power plants.

It is important to note that Shen Mu represents one of the only major coal fields found to date in China which can be exploited by surface mining methods. Development elsewhere will most likely be achieved via expansion of existing underground mines. This reduces the capital required and enables China to use its domestically manufactured underground mining equipment. This is of proven capability; some of which is actually being exported to the U.S.A.

Remaining with underground production is certainly the more logical route to take given China's coal geology. China's mining conditions are generally unfavorable by global standards. Surface mining accounts for only 4% of total production due to the depth of the majority of the mineable seams. The days of talk of developing huge surface pits with foreign partners (with an associated mandatory minimum percentage of exports) are history.

Conclusions

Chinese officials have often stated that, due to domestic requirements, China will not be a major player in the international markets. Part of the confusion with regard to China's future coal export levels is the definition of the term "major player". For while the Chinese admit that internal demands will limit export levels, in the same breath they predict exports of 30 million tonnes in 1990. To a corporate planner looking at development of his own coal resource for export, this so called "limited increase" has a drastic effect on his supply/demand forecast. In the coal export arena, 30 million tonnes, even if held constant to 2000, *is* a major player. This is especially problematic given that China, with its huge domestic base, can proceed without sales contracts and can fluctuate export volumes on a yearly basis. This implies heavy competition for the market and therefore softer prices than would otherwise occur. The "China potential" will always be a pending factor as long as consuming nations have not filled their China risk appetite, China's inherent operating costs are low and China's internal demands require that mine and infrastructure expansions be pursued regardless of the international market.

What does all of this mean? In short, corporate planners would be well advised to include increased Chinese exports in their forecasts. For Chase project analysis work, we are assuming that China reaches export levels of 25-30 million tonnes by 1990, 35-45 million tonnes by 1995 and 50-60 million tonnes by 2005. At the same time, we realize that these figures will be more variable than exports from countries more dependent on the international market. In other words, the spot and short term export market is a viable alternative for China since so much of its domestically consumed coal must already move to ports for transshipment.

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AUTHOR'S NOTE

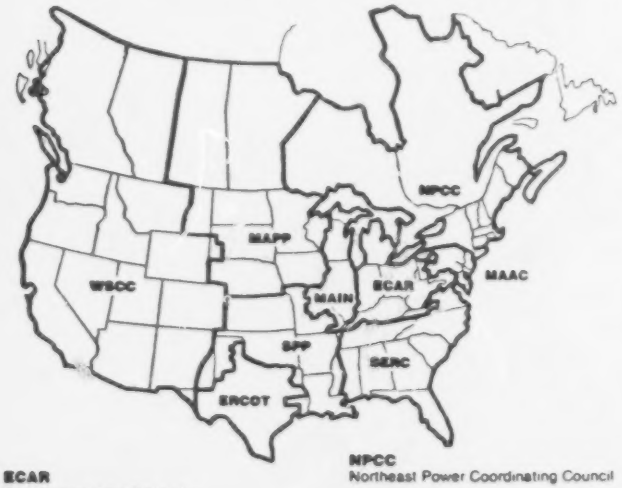
The projections provided in this analysis are those released by the North American Electric Reliability council (NERC) in its report, *1987 Electricity Supply & Demand*. They do not necessarily reflect the opinions of The Chase Manhattan Bank. Any citation of the information provided below should reference the original source.

NORTH AMERICAN ELECTRIC POWER SUPPLY & DEMAND 1987 – 1996

The North American Electric Reliability Council (NERC) recently published its annual survey of utility projections of electric power supply and demand in North America. The 1987 edition of the report *Electricity Supply & Demand** provides, on an aggregated regional basis (see Figure 1), NERC member utility projections of load requirements, capacity additions and fuel requirements for the years 1987 through 1996.

FIGURE 1

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL



ECAR
East Central Area Reliability Coordination Agreement

ERCOT
Electric Reliability Council of Texas

MAAC
Mid-Atlantic Area Council

MAIN
Mid-America Interpool Network

MAPP
Mid-continent Area Power Pool

NPCC
Northeast Power Coordinating Council

SERC
Southeastern Electric Reliability Council

SPP
Southwest Power Pool

WSCC
Western Systems Coordinating Council

AFFILIATE

ASCC
Alaska Systems Coordinating Council

The purpose of this issue of *The Coal Situation* is to summarize and review the latest NERC projections as to their meaning to Untied States coal producers.

*A copy of NERC's report, *1987 Electricity Supply & Demand for 1987–1996*, can be obtained from: North American Electric Reliability Council, 101 College Road East, Princeton, NJ 08540-6601.

Electricity Demand and Capacity Additions

As shown in Table 1, NERC utilities are projecting growth in U.S. net annual electric energy demand which averages 2.1 percent per year over the period 1986-1996 (1986 as base year). While slightly lower than the 2.3 percent per year growth contained in NERC's 1985 10-year projections, it still represents 23 percent growth in total power demand over the period.

TABLE 1

NERC PROJECTIONS OF NET ANNUAL ELECTRICAL ENERGY REQUIREMENTS FOR U.S. AND CANADIAN ELECTRIC UTILITIES

(Terawatt-hours)

NERC Region	1986 Actual	Projections 1987	Projections 1996	Average Annual Growth – %/Yr 1986-1996
ECAR	390.2	399.0	467.2	1.8
ERCOT	190.8	195.8	263.4	3.3
MAAC	197.1	199.4	230.9	1.6
MAIN	177.2	179.2	211.1	1.8
MAPP-U.S.	106.8	111.3	130.3	2.0
NPCC-U.S.	227.9	232.0	268.2	1.6
SERC	545.4	551.3	681.1	2.2
SPP	216.5	220.5	266.2	2.1
WSCC-U.S.	480.2	500.6	598.0	2.2
NERC-U.S. *	2,532.1	2,589.0	3,116.5	2.1
MAPP-Canada	27.1	28.1	37.0	3.2
NPCC-Canada	256.8	269.0	345.2	3.0
WSCC-Canada	72.9	76.5	101.9	3.4
NERC-Canada *	356.8	373.6	484.1	3.1

* Totals may not add due to independent rounding

Source: NERC, *1987 Electricity Supply & Demand for 1987-1996*, November, 1987

As for Canada, Canadian utilities are projecting a growth rate in annual electric energy demand of 3.1 percent per year over the period. Although regional adjustments have been made, the national rate of growth is essentially unchanged from last year's projections. (See The Coal Situation, Vol. 7 – No. 1)

To meet the growth in load requirements and to replace 10.4 gigawatts (GW) of planned unit retirements, the U.S. electric utilities in their submissions to NERC are planning to add 79.3 GW* of generating capacity over the period 1987-1996. As shown in Table 2, U.S. utilities are currently anticipating the addition of 22.7 GW of coal-fired capacity and 25.3 GW* of nuclear-based capacity over the decade. Together, these two energy sources comprise 60.5 percent of total U.S. utility planned capacity additions over the period with the

remaining additions represented by oil and gas, hydro, and others (geothermal, cogeneration, etc.).

In the case of Canadian utilities, a total of 13.1 GW of new capacity is planned to be added by 1996 (planned Canadian retirements total 0.5 GW between 1987-1996). Hydroelectric facilities, at 4.7 GW or 35.8 percent of the total is the principal form of new additions in Canada followed closely by nuclear facilities at 4.4 GW or 33.3 percent of the total. In third place is coal, with Canadian utilities anticipating the addition of 3.3 GW of capacity by 1996.

TABLE 2

NERC GENERATING UNIT
ADDITIONS, RETIREMENTS, AND CONVERSIONS 1987-1996

(Gigawatts)

	United States		Canada	
	Gigawatts	% of Total	Gigawatts	% of Total
Nuclear	25.3	31.9	4.4	33.3
Coal	22.7	28.6	3.3	25.5
Hydro	2.5	3.2	4.7	35.8
Oil/Gas	9.5	12.0	0.5	3.6
Pumped Storage	2.4	3.0	0.0	0.0
Other (Utility)	5.4	6.9	0.0	0.0
Other (Non-Utility)*	11.5	14.4	0.2	1.8
Total Additions**	79.3	100.0	13.1	100.0
Retirements	10.4		0.2	
Oil-to-Coal Conversions	1.2		0.5	

*Cogeneration and small power production facilities under PURPA and other non-utility generation reported by electric utilities. Of the total, 3,091 MW (U.S.) and 240 MW (Can.) are reported to be cogeneration capacity.

**Totals may not add due to independent rounding

Source: *1987 Electricity Supply & Demand for 1987-1996*, November, 1987

Based on the planned additions outlined above and current unit capabilities, U.S. and Canadian utilities are projecting the shares of net generation by fuel type provided in Table 3. As shown, the share of U.S. power generated with coal is projected to decline, falling to 52.9 percent from the 55.2 percent share of generation in 1986. This reflects increases in nuclear generation and "other" power generation most notably from non-utility owned facilities. Despite this fall-off in relative importance, U.S. utility coal consumption is expected to expand by almost 18 percent over the decade.

TABLE 3

NERC PROJECTED SHARE OF ELECTRICITY GENERATION BY ENERGY TYPE

(Percent)

	U.S.		Canada	
	1986 Actual	1996 Forecast	1986 Actual	1996 Forecast
Coal	55.2	52.9	18.7	19.5
Nuclear	16.9	21.4	18.8	22.5
Hydro	11.7	8.4	61.4	54.1
Oil	5.1	3.9	0.7	1.1
Gas	9.8	8.8	0.4	1.5
Other	1.4	4.5	0.1	1.3
Total*	100.0	100.0	100.0	100.0

*Totals may not add due to independent rounding

Source: NERC, *1987 Electricity Supply & Demand for 1987-1996*, November, 1987

NERC Projected Coal Requirements

The NERC projections of the quantity of coal to be consumed in generating electricity between 1987 and 1996 are shown in Table 4. In 1996, U.S. utilities are anticipating the use of 795.7 million net tons of coal. This represents an increase of 121.0 million tons over the actual quantity of coal consumed in 1986, an average compound rate of growth of 1.7 percent per year over the period.

As shown in Table 5, except for the latter years, this year's projected U.S. utility coal usage over the decade is essentially unchanged from NERC's assessment in 1986. This reflects a departure from the trend seen in previous NERC assessments, each of which showed lower projected growth in U.S. utility coal usage than the previous.

In the case of Canada, this year's NERC assessment indicates a marked upward revision in utility coal usage. As shown in Table 5, Canadian utilities have raised their anticipated coal usage over the period by between 6 percent to 13 percent over what they projected in their submissions to NERC in 1986. While a welcome sign for Canadian producers, the impact on U.S. exporters is certainly less than encouraging over the long run.

TABLE 5

COMPARISON OF NERC's 1986 AND 1987
PROJECTIONS OF NORTH AMERICAN UTILITY COAL CONSUMPTION

	United States		
	1986 Projections	1987 Projections	% Charge 1987 vs 1986
1986	675.9	674.7*	−0.2
1987	677.1	694.4	2.6
1988	692.7	699.1	0.9
1989	704.3	704.8	0.6
1990	710.7	720.1	1.3
1991	722.7	728.8	0.8
1992	740.0	740.2	0.0
1993	756.8	748.4	−1.1
1994	775.6	761.1	−1.8
1995	797.4	774.8	−2.8
1996	–	795.7	NA

	Canada **		
	1986 Projections	1987 Projections	% Charge 1987 vs 1986
1986	36.5	39.6*	8.5
1987	36.2	39.3	8.6
1988	35.9	39.6	10.3
1989	35.5	40.4	13.8
1990	38.0	41.0	7.9
1991	39.8	42.3	6.3
1992	40.3	43.7	8.4
1993	41.2	45.1	9.5
1994	42.6	48.2	13.1
1995	44.8	50.4	12.5
1996	–	55.2	NA

* Actual 1986 consumption

NA: Not Applicable

Source: NERC, *1986 Electricity Supply & Demand 1986-1995*, October, 1986 and NERC, *1987 Electricity Supply & Demand for 1987-1996*, November, 1987

TABLE 4

NERC PROJECTED NORTH AMERICAN UTILITY COAL CONSUMPTION 1987–1996

(1000 Net Tons)

	ACTUAL 1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
NERC-U.S.											
ECAR	181990	184690	181050	184068	184910	185720	187590	189160	192180	195480	198590
ERCOT	57023	61655	63409	63444	65686	67790	70601	73604	79672	83673	88755
MAAC	40036	39524	39588	39926	38842	38501	38989	39408	39239	39640	40881
MAIN	55688	53408	51233	51890	53081	52913	55658	56374	56302	58393	58019
CMNWLTH EDISON	13509	11720	9610	8570	9410	8700	9640	10270	10250	10830	11420
EAST MISSOURI	9999	10290	9695	10803	11443	11083	12045	12257	11586	12665	12400
S CENT ILLINOIS	16110	14445	14683	15051	14363	14956	15420	15147	15577	15801	14778
WIS-UPPER MICH	16070	16953	17245	17466	17865	18174	18553	18700	18889	19097	19421
MAPP	40926	52107	55738	54547	55662	56567	55042	56057	56529	56971	58908
NPCC	13621	15128	15013	14820	15267	15648	16122	16316	16714	17228	17814
NEW YORK	8316	9095	9471	9255	9940	10309	10761	10956	10923	11349	11685
NEW ENGLAND	5305	6033	5542	5565	5327	5339	5361	5360	5791	5879	6129
SERC	135965	126793	127894	127389	134036	135312	137472	137413	137855	137471	143520
FLORIDA	15152	15004	17918	20455	21538	21728	21882	22430	22442	22356	22706
SOUTHERN	48825	44474	44084	43648	45941	47215	47961	46657	46250	46742	47011
TVA	34735	33391	30210	29239	29513	29324	28769	26637	27003	25798	28411
VACAR	37253	33924	35682	34047	37044	37045	38860	41689	42160	42575	45392
SPP	69296	72366	73393	74169	77094	77602	78493	79329	80701	81838	83015
SOUTHEAST	17844	16851	16812	16842	16541	16675	17346	17461	17823	18003	17944
WEST CENTRAL	26685	29133	29576	30394	32626	32528	32698	33323	34157	34705	35423
NORTHERN	24767	26382	27005	26933	27927	28399	28449	28545	28721	29130	29648
WSCC	80115	88727	91756	94565	95501	98722	100275	100695	102072	104099	106163
NW POOL	28737	36102	37253	39954	41430	42472	42609	42584	42455	43041	42843
ROCKY MT-AREA	17053	16431	17050	17616	17745	18250	18697	19335	19883	20567	21282
ARIZ-N. MEX	19667	21471	22390	22597	21894	23117	23779	24307	24695	25392	26233
CALIF-SO. NEV	14658	14723	15063	14398	14432	14883	15190	14469	15039	15099	15805
TOTAL (U. S.)	674660	694398	699074	704818	720079	728775	740242	748356	761264	774793	795665
NERC-CANADA											
MAPP	7759	7852	8402	8671	8874	9148	9633	9839	10020	10305	10771
NPCC	12742	11613	10828	10523	9531	9251	9131	9822	11660	12261	15520
NEW BRUNSWICK	517	580	710	1105	1177	1141	1200	1538	2400	2422	2429
NOVA SCOTIA	2136	2174	2293	2346	2389	2584	2987	3082	3290	3407	3568
ONTARIO	10089	8859	7825	7072	5965	5526	4944	5202	5970	6432	9523
QUEBEC	0	0	0	0	0	0	0	0	0	0	0
WSCC	19144	19866	20408	21218	22623	23871	24976	25456	26492	27849	28994
TOTAL (CANADA)	39645	39331	39638	40412	41028	42270	43740	45117	48172	50415	55285

Source: NERC, *1987 Electricity Supply & Demand for 1987–1996*, November, 1987.

As shown in Table 6, NPCC-Ontario, more specifically Ontario Hydro, is projected higher than previously expected imports from the U.S. in 1987, 1988 and 1989. However, the forecasted level of imports remains significantly lower than historical standards (consumption 8.6 million tons in 1985). More specifically, they are not projected to exhibit any recovery until the latter part of the decade.

TABLE 6

COMPARISON OF NERC's 1986 AND 1987 PROJECTIONS OF U.S. COAL IMPORTS BY NPCC-ONTARIO

(Million Net Tons)

	NPCC—Ontario		
	1986 NERC Projections	1987 NERC Projections	% Change 1987 vs 1986
1986	5.9	7.0*	18.6
1987	4.7	5.6	19.1
1988	3.6	4.7	30.6
1989	2.5	3.9	56.0
1990	3.0	3.0	0.0
1991	3.2	2.8	−12.5
1992	2.5	2.2	−12.0
1993	5.2	2.4	−53.8
1994	5.4	3.2	−40.7
1995	6.7	3.6	−46.3
1996	—	6.7	NA

* Actual

NA: Not Applicable

Source: NERC, *1986 Electricity Supply & Demand 1986-1995*, October, 1986 and NERC, *1987 Electricity Supply & Demand for 1987-1996*, November, 1987.

As for the sources of coal supply for the U.S. NERC utilities, the vast majority of their anticipated requirements continue to be projected to come from mines located west of the Mississippi River. As shown in Table 7, NERC utilities have identified the geographical mining location for 104.4 million tons of the total 121.0 million tons of additional coal projected to be consumed by U.S. electric utilities in 1996. Of the total for which mining locations have been indicated, 89.6 percent is projected to be mined west of the Mississippi River. As shown, this year's forecasts of lignite usage shows an incremental increase of only 22.0 million tons by 1996. This is in sharp contrast to the 1986 assessment which indicated that 48.1 million tons of the then identified total 80.3 million ton increase in Western coal usage would be lignite. While growth in lignite consumption has been reduced, the projected incremental growth in "other" Western coal usage has more than doubled the incremental quantity forecasted in the 1986 NERC report. In this year's report, U.S. utilities have indicated an incremental growth of 71.5 million tons of nonlignite Western coal consumption between 1986 and 1996 versus a projected growth of 32.2 million tons shown in the 1986 NERC assessment. If proven to be correct, this represents good news for Powder River basin and other non-lignite producers in the Western states.

*Excludes Perry 2, WNP1 and WNP3 nuclear units.

TABLE 7

NERC UTILITY PROJECTED SOURCES OF U.S. UTILITY COAL SUPPLIES

Coal Production Regions	Net Increase 1986-1996 (Million Tons)	Percent of Total Identified
East of Mississippi River & Imports	10.9	10.4
West of Mississippi River		
— Lignites	22.0	21.1
— Others	71.5	68.5
Total Identified Sources	104.4	100.0
Unidentified Sources	16.6	
Grand Total	121.0	

Source: NERC, *1987 Electricity Supply & Demand for 1987-1996*, November, 1987

Summary and Conclusions

In summary, the latest NERC projections of North American electric power supply and demand indicate a stabilization in electricity demand growth rates in the United States and more importantly a stabilization in the forecasted rate of growth in coal usage. Existing U.S. Western coal producers should take heart in light of the fact that the utilities they serve are indicating a recovery in market demand. While for Eastern coal producers the much more modest increase in projected coal usage by the utilities they serve coupled with lower import demand by Canada imply a continuation of a buyers market.

Vincent J. Calarco, Jr.
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The Coal Situation

A quarterly review from the Project Evaluation Committee, THE CHASE MANHATTAN BANK, N.A., NEW YORK, N.Y.

Vol. 8 – No. 2
MARCH, 1988

INTERNATIONAL COAL TRADE – 1988

An estimated 340.9 million metric tons (tonnes) of coal were traded internationally last year, 1.4 percent greater than the previous record of 336.1 million tonnes achieved in 1986.

The purpose of this issue of *The Coal Situation* is to review the performance of coal trade in 1987 and to provide an outlook for trade flows in 1988.

Review of 1987

The world steel producing countries imported 164.4 million tonnes of metallurgical coal in 1987. This represents an increase of slightly more than 3 million tonnes from the level of trade attained in 1986. As shown in Table 1, with the exception of Japan, most regions of the world expanded their imports of metallurgical coal*, with Other Asia showing the greatest growth which reflects the strong performance by the Republic of Korea and Taiwan. As expected, metallurgical coal imports by Japan fell in 1987, although its performance was stronger than expected. (See The Coal Situation Vol. 7 – No. 2.)

In the thermal coal segment of the market, low electricity growth rates and increased nuclear power production led to reduced imports by the EEC-12 and Other Western European countries. The most significant contributors to the fall-off in EEC-12 imports were France (-3.9 million tonnes), Germany

TABLE 1
WORLD HARD COAL IMPORTS 1987 VERSUS 1986
(Million Metric Tons)

	METALLURGICAL COAL			THERMAL COAL			TOTAL		
	1986 (R)	1987 (P)	% Change	1986 (R)	1987 (P)	% Change	1986 (R)	1987 (P)	% Change
North America	5.8	6.1	5.2	9.3	10.2	9.7	15.1	16.3	7.9
Latin America	11.4	12.6	10.5	0.7	1.0	42.9	12.1	13.6	12.4
EEC-12	34.3	36.0	5.0	68.8	65.0	– 5.5	103.1	101.0	– 2.0
Other W. Europe	9.6	9.6	0.0	12.6	12.2	– 3.2	22.2	21.8	– 1.8
Eastern Europe	13.9	14.3	2.9	25.0	25.7	– 2.8	38.9	40.0	2.8
Japan	69.7	67.1	– 3.7	21.7	25.5	17.5	91.4	92.6	1.3
Other Asia	13.3	15.7	18.0	32.8	32.4	– 0.3	46.1	48.1	4.3
Others	3.0	3.0	0.0	4.2	4.5	7.1	7.2	7.5	4.2
Total	161.0	164.4	1.9	175.1	176.5	0.8	336.1	340.9	1.4
Seaborne*	137.3	141.9	3.4	138.2	141.1	2.1	275.5	283.0	2.7

*Excluding overland, barge and lake deliveries
(R) Revised
(P) Preliminary

*Metallurgical coal is defined to be coal used in the production of coke and for direct blast furnace injection.

(-1.9 million tonnes), and the United Kingdom (-1.0 million tonnes). The EEC-12 imports from third-party countries are shown in Table 2. The difference between the EEC-12 total imports (Table 1) and third-party imports (Table 2) represents imports from EEC coal producers (Germany, France, Belgium and the U.K.).

TABLE 2
EEC-12 HARD COAL IMPORTS FROM THIRD PARTY COUNTRIES
(Million Metric Tons)

				Percent Change	
	1985	1986	1987(P)	1986/85	1987/86
Germany	9.05	9.40	7.64	3.9	18.7
France	15.19	13.88	11.60	− 9.2	−16.4
Italy	20.44	18.99	19.00	− 7.1	0.1
Netherlands	10.99	11.55	11.80	5.1	2.2
Belgium	6.85	6.79	7.43	− 0.9	9.4
Luxembourg	0.14	0.16	0.17	14.3	6.3
United Kingdom	11.37	9.75	8.93	−14.2	− 8.4
Ireland	1.34	2.03	2.70	51.5	33.0
Denmark	11.36	11.07	11.40	− 2.6	3.0
Greece	1.98	1.76	1.70	−11.1	− 3.4
Spain	8.35	8.59	9.20	2.9	7.1
Portugal	1.20	1.48	2.60	23.3	75.7
Total	98.24	95.53	94.18	− 2.8	− 1.4

(P) Preliminary
Source: Eurostat, "Rapid Reports, Energy", March, 1988

On the exporting side, (Table 3) the United States, Poland and South Africa were the big losers in 1987. For the United States, the fall-off in its exports reflects the combination of reduced market demands (Europe) and displacement by other cheaper suppliers. Poland, on the other hand, was plagued by a strong domestic demand which limited exports while South Africa was negatively affected by trade restrictions. Stepping into the void created by the competitive, structural or social/political difficulties of these nations were Australia, Colombia, China, and the Soviet Union. The net result was a further strengthening of Australia's position as the world's largest coal exporter with total exports of 102.0 million tonnes in 1987, a 10 million tonne increase over 1986.

The growth in Australian trade in 1987 reflects a 6.2 million tonnes increase in metallurgical coal exports and a 3.8 million tonnes increase in thermal coal trade. Since alternative major new competitors are lacking in the metallurgical coal sector, Australia gained from the expansion of the market and its competitive position vis-a-vis the other major suppliers, namely the United States and Canada. This situation is slightly different on the thermal coal side where the continued expansion of Colombia and China provided competitive alternatives thus leading to a 3.8 million tonne increase in Australian exports, a 3.4 million tonne increase for Colombia, and a 2.1 million tonne increase in Chinese thermal coal trade in 1987.

Before proceeding to a review of the forecast for 1988, it is important to make note of performance of this author's 1987 forecast. Table 4 shows a comparison of last year's forecast of seaborne trade versus the estimated results for 1987. As shown, actual metallurgical coal trade slightly exceeded the high range of the 1987 forecast, while actual thermal coal trade fell between the medium and high projections. In total, actual trade was 2.4 percent greater than the forecasted medium range of seaborne trade for 1987.

TABLE 3
WORLD HARD COAL EXPORTS 1987 VERSUS 1986
(Million Metric Tons)

	METALLURGICAL COAL			THERMAL COAL			TOTAL		
	1986 (R)	1987 (P)	% Change	1986 (R)	1987 (P)	% Change	1986 (R)	1987 (P)	% Change
United States	49.8	46.9	− 5.8	27.8	25.3	− 9.0	77.6	72.2	− 7.0
Australia	48.7	54.9	12.7	43.3	47.1	8.8	92.0	102.0	10.9
South Africa	5.1	4.3	−15.7	40.4	38.3	− 5.2	45.5	42.6	− 6.4
Canada	21.4	22.1	3.3	4.5	4.2	− 6.7	25.9	26.3	1.5
Colombia	0.6	0.8	33.3	5.6	8.8	57.1	6.2	9.6	54.8
West Germany	5.2	3.6	−30.8	2.3	2.0	−13.0	7.5	5.6	−25.3
United Kingdom	0.1	0.1	0.0	2.7	2.3	−14.8	2.8	2.4	−14.3
Poland	11.7	11.2	− 4.3	22.7	19.8	−12.8	34.4	31.0	− 9.9
USSR	12.0	13.0	8.3	13.4	14.1	5.2	25.4	27.1	6.7
PRC	3.2	4.3	34.4	6.7	8.8	31.3	9.9	13.1	32.3
Others	3.2	3.2	0.0	5.7	5.8	1.8	8.9	9.0	1.1
Total	161.0	161.4	2.1	175.1	176.5	− 0.8	336.1	340.9	1.4
Seaborne*	137.3	141.9	3.4	138.2	141.1	2.1	275.5	283.0	2.7

(R) Revised
(P) Preliminary

TABLE 4

COMPARISON OF ACTUAL VERSUS FORECASTED SEABORNE COAL TRADE IN 1987

(Million Metric Tons)

	METALLURGICAL	THERMAL	TOTAL
1987 Forecast*			
Low	131.8	134.5	266.3
Medium	135.9	138.6	274.5
High	141.0	145.1	286.1
1987 Actual (P)	141.9	141.1	283.0

(P) Preliminary

*Source: Chase Manhattan Bank, N.A., *The Coal Situation*, Vol. 7 – No. 2, March, 1987.

Outlook for 1988

The medium forecast of coal trade in 1988 is based on the assumption that world economic activity over the course of the year is little affected from 1987.

For the metallurgical coal segment, despite strong local currencies, little net change in the industrialized world metallurgical coal import requirements (Western Europe and Japan) is expected. This partially reflects some displacement of expensive domestic coal production by relatively cheaper imports. In total, growth in trade is the result of expanded requirements by Brazil, Japan, Taiwan and Korea, leading to a 4.1 million tonne increase over 1987 to 168.5 million tonnes of metallurgical coal trade in 1988.

On the downside it must be recognized that while current indicators imply no major change in economic activity for the year, there still exists the possibility of deterioration in 3rd and 4th quarters which in combination with a weak dollar leads to decreased steel demand and production in Japan and Europe. This situation is portrayed under the Low forecast provided in Table 5 which shows a 1.1 million tonne decrease from 1987 to 163.3 million tonnes in 1988. On the upside (High forecast), a continued strong showing for domestic steel demands in Europe and Japan coupled with greater displacement of higher cost domestic supplies could lead to a further strengthening of the market to over 172 million tonnes.

For the thermal coal sector, it is assumed that oil prices exhibit a seasonal recovery, with price fluctuating between $15 and $20 a barrel for the remainder of the year. The combination of scheduled coal-fired power plant startups and continued utilization of existing units leads to a medium range forecast of 176.7 million tonnes of thermal coal trade in 1988.

As indicated in the Medium forecast shown in Table 5, there will be shifts in the area of growth for thermal coal trade as experienced in 1987. Most significant is the expected decline in EEC imports, primarily the result of decreased French imports which are partially offset by increased trade by other Europeans.

Also provided in Table 5 is the range in thermal coal import requirements which recognize the uncertainties surrounding the key forecasting parameters such as oil price, hydro-electric generation, operating performance of nuclear plants, and the strength of economic activity and its influence on electricity demand and cement production. The Low Case assumption results in a projected 171.2 million tonnes of thermal coal trade, 5.3 million tonnes less than experienced in 1987. On the upside, the more optimistic High Case assumptions produce a

TABLE 5

WORLD HARD COAL TRADE FORECAST

(Million Metric Tons)

	METALLURGICAL				THERMAL				TOTAL			
	1987	1988			1987	1988			1987	1988		
	(P)	Low	Med.	High	(P)	Low	Med.	High	(P)	Low	Med.	High
Importers												
North America	6.1	5.9	6.1	6.3	10.2	8.7	9.2	9.2	16.3	14.6	15.3	15.5
Latin America	12.6	13.7	14.2	14.2	1.0	0.9	1.0	1.1	13.6	14.6	15.2	15.3
EEC	36.0	34.3	35.3	36.3	65.0	62.0	62.8	65.8	101.0	96.3	98.1	102.1
Other W. Europe	9.6	9.3	9.8	9.8	12.2	12.5	13.2	13.4	21.8	21.8	23.0	23.2
Eastern Europe	14.3	13.5	14.2	14.8	25.7	25.0	26.0	26.0	40.0	38.5	40.2	40.8
Japan	67.1	67.0	68.5	70.0	25.5	25.0	26.0	26.5	92.6	92.0	94.5	96.5
Other Asia	15.7	16.7	17.2	17.5	32.4	32.5	33.5	34.4	48.1	49.2	50.7	51.9
Others	3.0	2.9	3.2	3.2	4.5	4.6	5.0	5.0	7.5	7.5	8.2	8.2
Total	164.4	163.3	168.5	172.1	176.5	171.2	176.7	181.4	340.9	334.5	345.2	353.5
Exporters												
United States	46.9	45.6	46.5	48.3	25.3	20.3	20.6	22.8	72.2	65.0	67.1	71.1
Australia	54.9	55.4	56.7	57.5	47.1	46.0	48.0	49.0	102.0	101.4	104.7	106.5
South Africa	4.3	4.3	4.8	5.2	38.3	36.0	37.5	38.0	42.6	40.3	42.3	43.2
Canada	22.1	22.4	23.5	24.0	4.2	4.2	4.2	4.5	26.3	26.6	27.7	28.5
Colombia	0.8	0.8	0.8	0.8	8.8	11.0	11.0	11.5	9.6	11.8	11.8	12.3
Poland	11.2	10.4	11.0	11.0	19.8	18.0	19.0	19.0	31.0	28.4	30.0	30.0
USSR	13.0	13.6	14.1	14.1	14.1	14.1	14.1	14.1	27.1	27.7	28.2	28.2
PRC	4.3	4.8	5.1	5.2	8.8	12.0	12.3	12.5	13.1	16.8	17.4	17.7
Others	6.9	6.0	6.0	6.0	10.1	9.6	10.0	10.0	17.0	15.6	16.0	16.0
Total	164.4	163.3	168.5	172.1	176.5	171.2	176.7	181.4	340.9	334.5	345.2	353.5
Seaborne	141.9	141.5	147.7	150.3	141.1	138.7	144.7	149.4	283.0	280.2	292.4	299.7

(P) Preliminary

forecast of 181.4 million tonnes of trade for 1988, an increase of 4.9 million tonnes over the 1987 performance.

With regard to exports, the United States is expected to continue to act as the main swing supplier bearing the brunt of variations in demand, increased supplies from more competitive traditional suppliers (Australia), and the continued expansion of new suppliers (Colombia and China).

In terms of seaborne coal trade, as has been the experience in the past, higher cost intra-regional non-seaborne trade is expected to continue to deteriorate leading to a more modest decline in seaborne trade under the Low Case scenario and a higher percentage growth in seaborne trade under the Medium and High forecasts. Under the Medium forecast a total of 292.4 million tonnes of a seaborne trade is projected for 1988, a 3.3 percent increase over 1987.

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THE COAL SITUATION

CHASE

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JULY, 1988

TECHNOLOGY AND THE METALLURGICAL COAL MARKET

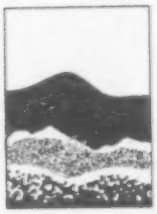
It wasn't too many years ago that the terms "metallurgical coal" and "coking coal" characterized a specific group of coals possessing the chemical and physical properties ideally suited for the manufacturing of coke. These coals, when blended and processed in a coke oven, produced the quality of coke needed for the efficient operation of a blast furnace in the production of pig iron.

In general, quality requirements limited the number of coals which could be legitimately classified as met or coking grades. As such, these coals routinely commanded higher prices owing to their relative scarcity and higher cost of extraction and processing.

It should come as no surprise that cost and relative scarcity provided the impetus for change in the structure of the metallurgical coal market as steel producers, particularly those in Japan, searched for better and cheaper ways to produce iron and steel.

Through technological advances the range of coals suitable for coke making has been expanded. Today, coals which were once considered unacceptable are now routinely charged into coke batteries. In addition, the world steel industry has developed techniques to reduce its need for coke. One of the most significant developments in this area is the direct injection of coal into the blast furnace. This technique known as pulverized coal injection (PCI) utilizes coals whose qualities have historically limited their applications to the steam or thermal markets.

As a result of technological change, the metallurgical coal market of today differs from that of ten years ago. Likewise, through technology, the market of tomorrow will differ from the market of today. The purpose of this issue of ***The Coal Situation*** is to review the technical innovations in the manufacturing of coke and the production of pig iron that are impacting the metallurgical coal markets.



THE TECHNOLOGY OF COKE MAKING

Technological improvements in coke making have been concentrated on the utilization of cheaper non-traditional coals to produce coke possessing the strength and quality needed by the modern blast furnace. The Japanese have been the leader in this area.

Being dependent upon imports for the vast majority of their coking coal needs and having experienced significant price increases in the middle Seventies and early Eighties, Japanese steel producers set about the task of finding ways to utilize coals never before considered for use in the production of coke. And, successful they have been!

From the start of experimentation in the early Seventies, Japanese usage of what they refer to as "semi-soft" or "non-weak" coking coals in the manufacturing of coke has grown rapidly, reaching a level of 10 to 11 million tonnes in 1987*. The vast majority of the growth, however, has occurred since 1980 as technological innovations were employed at their coke making facilities. The technologies adapted individually or collectively include: selective crushing, briquetted coal blending, precarbonization, moisture control, and coke dry quenching (CDQ).

Selective crushing addresses the need to uniformly disperse the inert (ash) components of the non-traditional coals in order to produce a homogenized coke. This process takes advantage of the fact that the volume of inert components is dependent on the size of the particle of coal. By selective crushing, desirable bulk density of the charge is maintained and coke strength is improved.

In ***briquetted coal blending*** approximately 30 percent of the blend coal is briquetted with a binder (pitch) and then charged in the ovens. The purpose of this technique is to improve bulk density and to make up for reduced fluidity with the binder, thus producing the desirable coke strength while using non-traditional coking coal.

(Continued on page 2)

Precarbonization consists of heating and drying coals outside the coke oven to a temperature of approximately 200°C. As in the techniques outlined above, the purpose of precarbonization is to increase the bulk density of the charge and thus increase coke strength. In addition, however, precarbonization also improves coke production capacity by reducing carbonization time. Heat consumption is also reduced during the final coking process.

The *control of coal moisture* process utilizes waste heat from the steel making process to dry the coal before charging. While operating at lower temperatures, the effects of this technique are similar to the precarbonization technique outlined above.

Coke Dry Quenching (CDQ) is a process originally aimed at reducing environmental emissions. Developed to replace water in cooling the 1000°C high temperature coke discharged from the batteries, CDQ utilizes inert gas such as nitrogen to cool the coke following carbonization. Heat is collected from the hot gases for alternative uses such as power generation. While aiding heat recovery, CDQ provides the added benefit of increasing coke strength through gradual cooling thus supporting the use of non-weak coking coals.

Through the application of the processes outlined above, Japanese coke producers have been able to maintain coke quality while at the same time lowering their costs of production by increasing their use of cheaper, low quality non-coking coals in their coal blends. At the present time, these non-traditional coking coals represent approximately 23 percent of the country's coking coal needs and will continue to grow as the application of these technologies expand.

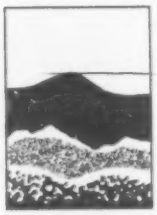
In other countries, the adaptation of the Japanese techniques have been slower but nevertheless on the increase as attention is focused on lowering the cost of steel production. From the standpoint of the metallurgical coal markets, the key question is "what are the ultimate limits to this trend?" Once again we can turn to the Japanese for the answer.

By the end of this century, Japan will be faced with the question of coke oven rebuilts or replacement as existing batteries approach the end of their 30 year service life. A number of alternatives are being pursued, all of which focus on finding a less expensive way of producing steel. From the point of view of coke making, one alternative being examined is the use of formed coke.

The *formed coke process* does not employ the traditional chamber type coke oven. Rather, it uses a shaft-type furnace in which briquetted coal is continuously carbonized. The briquetted coal is a blend consisting of more than 70 percent non-weak coking coal. Pitch is used as the binder.

Investigation of the formed coke process is not new nor has it been limited to Japan. The basic concept has been under experimentation since the 1960's in the U.S., the USSR, Canada, Australia, West Germany, France, Belgium, and the U.K. The key to its adaptation is one of economics. That is, the production of coke at a cost lower than traditional coke ovens. This is a function of the cost of coking coal, capital costs, and the quality of coke required.

While formed coke is one alternative to the issue of coke oven replacement, other technologies are addressing the need of coke itself in the production of pig iron.



THE TECHNOLOGY OF PIG IRON PRODUCTION

Pulverized coal injection (PCI) is a technique whereby coal is injected directly into the blast furnace to replace a portion of the coke needed to produce pig iron. Prior to the significant increase in oil prices, oil served the same purpose.

Just as oil replaced coke and vice versa when oil prices increased in the 1970's, the driving force behind the increasing use of PCI is one of economics.

- First, by avoiding the coking process, each ton of coke replaced by PCI eliminates 1.4 to 1.6 tonnes of coal needed in the carbonization process.
- Second, PCI coals are the cheaper, non-weak or semi-soft coking coals.
- Third, the investment for injection is considerably less than that required in coal ovens.
- Finally, blast furnace control is improved and the quality of blast furnace gas is enhanced thereby improving overall energy balances.

Once again Japan has been the most active in the installation of PCI systems. From its introduction in 1981, Japanese usage has grown to over 2 million tonnes of injected coal in 1987. At present, PCI units have been installed at 18 of the 37 operating blast furnaces in Japan. At these facilities an average of 60 to 80 kilograms of pulverized coal per tonne of pig iron are being injected into the furnaces, with a high of over 100 kilograms per tonne being achieved at Kobe Steel's Kobe works.

In other parts of the world, PCI units have been installed or are being experimented with in the United Kingdom, Sweden, Belgium, Germany, Italy, Korea, Taiwan, and the Netherlands. In total, there are an

*An additional 2-2.5 million tonnes of non-weak coking coals are injected directly into the blast furnace.

estimated 32 PCI units in operation in the non-Communist world. It is interesting to note that the most prevalent PCI process installed to date was developed by two American companies, Armco, a steel producer, and Babcock and Wilcox.

In short, there is little doubt that PCI and the use of non-traditional coals in the manufacturing of pig iron will be on the increase. The actual level of introduction will be dictated by the price of oil, the need for coke oven rebuilds, and the price of traditional coking coals.

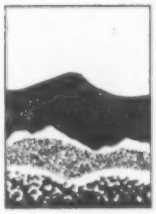
In terms of impact, PCI is a new technology whose full potential is not fully known. Those firms developing the technology suggest that injection rates of 150 to 200 kilograms per tonne of pig iron are achievable. In the longer term, however, even greater potentials are possible.

The Japanese are currently experimenting with ***blast furnace oxygen injection*** with the aim of achieving an injection rate of more than 300 kilograms of pulverized coal per tonne of pig iron. The goal here is to increase the productivity of the blast furnace from the current 2.0 tonnes per cubic meter per day to more than 3.0 tonnes per cubic meter per day while maintaining the existing structure and configuration of the furnace. As is the case with its investigation of formed coke, one of the driving forces behind Japan's experimentation with oxygen blast furnace operation is the need to rebuild coke batteries by the turn of the century. For the same reason, Japan is investigating the ***smelting reduction process*** as a technique to produce pig iron that could totally eliminate the need for coke.

In the ***smelting reduction process***, iron ore is reduced after melting it at temperatures exceeding 1500°C. The process utilizes coal directly as the reducing agent eliminating the traditional blast furnace and its need for coke and associated coke ovens. Other potential advantages are reported to include (1) reduction times 10 times faster than conventional iron making and (2) the use of fine or lump ores which do not require pretreatment, thereby eliminating sintering and pelletizing plants.

As with formed coke, Japan is not alone in its experimentation with non-coke based pig iron production. One example is the coal-based direct reduction iron-making process developed by Korf Engineering (Duesseldorf), now 49 percent owned by Voest-Alpine AG. Originally known as the Kohl Reduktion (KR) process, the system is currently being marketed by Voest-Alpine under the registered name COREX.

As with Japan's smelting reduction process, the COREX system completely eliminates the need for coke. The key difference being that the system is closer to commercialization. The state-owned South African iron and steel firm, ISCOR, signed the first contract for a commercial plant utilizing the COREX technology. It is understood that this facility, with a capacity of 300,000 tonnes of iron per year, is due to be completed in 1989 at ISCOR's Pretoria steel works. The United States is also examining the possibility of constructing a facility under its Clean Coal Technology Program.



SUMMARY AND CONCLUSIONS

Economic forces have led to technological improvements in the making of coke and pig iron resulting in the increased use of coals which historically were considered unsuitable for metallurgical applications. There is little doubt that the drive to improve the overall cost structure in the manufacturing of steel will continue. Therefore, wider application of existing technologies and the commercialization of new innovative processes will be pursued. The aim will be to improve the cost of steel making through the use of lower cost raw materials, reduced capital requirements and increased overall productivity at aging, existing steel making facilities, as well as those facilities developed to meet incremental growth in the market.

Therefore, the long term trend will be for the continued growth in the use of non-traditional coking coals in non-traditional ways in the manufacturing of steel. The strength of this trend will be dictated by the (1) relative cost of traditional versus non-traditional coking coals, (2) the cost of oil, (3) strength of the steel market and (4) magnitude of environmental pressures on coke making.

While there is little doubt that the use of non-traditional coals in steel making will be on the increase, there is equal certainty that the need for high grade traditional coking coals will remain. After all, the coke oven/blast furnace will continue to be the backbone of the world steel industry for many more years. And, while the demand for non-traditional coal will be on the increase, there still remains the need to blend higher quality materials. In fact, market niches will develop for coals with unique high grade metallurgical properties needed to support the maximum utilization of the lower grade materials. Prices will recognize these qualities.

Finally, the shift to non-traditional coking coals took advantage of a supply/demand imbalance in the market which produced low prices for these coals relative to the higher quality traditional metallurgical grades. It must

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be recognized that the "non-weak" coking coals being used for coke blending or PCI happen to be the higher grades of thermal coal. This means that as market demands expand in the thermal and metallurgical sectors, the competition for these materials will produce higher prices. At the same time, the cost of producing higher grades of coking coal will decrease because of increased productivity through technological improvements and changes in work practices. Thus, the differential between higher grade and non-traditional coking coals will narrow, leading to greater stability between the two. Regardless, the key point of this analysis is that the continuing emphasis on improving the cost of making iron and steel through technological innovation will further affect the size and structure of what has been historically called the "metallurgical" or "coking" coal market.

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